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The Influence of Surgical Treatment on Reported Ailments and Neurological Status of Patients with Spine Discopathy

Wpływ leczenia operacyjnego na zgłaszane dolegliwości i stan neurologiczny chorych z dyskopatią kręgosłupa

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Abstract

Introduction. Treatment of patients with spine discopathy is the subject of interest in numerous medical disciplines and includes non-invasive as well as invasive methods. Both therapeutic ways aim to resolve the disc-root conflict. The clinical picture and the incidence of neurological complications depend on the location of herniated nucleus pulposus.

Aim. To determine the influence of surgical treatment on reported ailments and neurological status of patients with spine discopathy.

Material and Methods. The study was conducted twice (before and after the surgery) among 188 patients treated surgically due to cervical or lumbosacral spine discopathy. The analysis included: clinical and intraoperative diagnosis, the level of operation, BMI, and neurological status: Laseque's sign, muscle strength, pain, dysesthesia, sphincter disorders. The results were analyzed by means of Microsoft Excel spreadsheet and Statistica 6.0, assuming a significance level of $p \leq 0.05$.

Results. While assessing pain, in the case of L-S discopathy, the majority of patients belonged to group III (34%) and group IV (33.5%). After the operation, 37.8% of patients were classified as group II; in cervical discopathy this percentage was 12.2%. The positive Laseque's sign before the operation was observed in 68.1% of the subjects; after the surgery in 56%. Dysesthesia in the case of the upper discopathy occurred in 72.9% of the patients, after the surgery in 30.3% ($p < 0.05$).

Conclusions. Performed surgery significantly results in reducing pain in patients. The improvement was also noticed in neurological status. (JNNS 2015;4(3):109–116)

Key Words: discopathy, assessment, pain, neurological status

Streszczenie

Wstęp. Leczenie pacjentów z dyskopatią kręgosłupa jest przedmiotem zainteresowania wielu dyscyplin medycznych i obejmuje metody nieinwazyjne oraz inwazyjne. Obydwa sposoby terapeutyczne zmierzają do rozładowania konfliktu dyskowo – korzeniowego. Obraz kliniczny i częstość powikłań neurologicznych zależą od lokalizacji przepukliny jądra miazdżystego.

Cel. Określenie wpływu leczenia operacyjnego na zgłaszane dolegliwości i stan neurologiczny badanych z dyskopatią kręgosłupa.

Materiał i metody. Badania przeprowadzono dwukrotnie (przed zabiegiem i po operacji) wśród 188 chorych, leczonych operacyjnie z powodu dyskopatii szyjnej lub lędźwiowo-krzyżowej kręgosłupa. W analizie uwzględniono: rozpoznanie kliniczne i śródoperacyjne, poziom operacji, wskaźnik BMI oraz stan neurologiczny: objaw Laseque'a, siłę mięśniową, ból, zaburzenia czucia, zaburzenia zwieraczy. Wyniki przeprowadzono arkuszem kalkulacyjnym Microsoft Excel i Statistica 6.0, przyjmując poziom istotności $p \leq 0.05$.

Wyniki. Oceniając ból, w przypadku dyskopatii L-S, badani w większości kwalifikowali się do grupy III (34%) oraz do grupy IV (33.5%). Po operacji 37.8% pacjentów zaszeregowano do grupy II; w dyskopatii szyjnej odsetek ten

wyniósł 12.2%. Dodatni objaw Laseque’a przed operacją miało 68.1% badanych; po operacji – 56%. Zaburzenia czucia w dyskopatii górnej występowały u 72.9% badanych, po zabiegu u 30.3% pacjentów ($p < 0.05$).

Wnioski. Przeprowadzony zabieg operacyjny w istotny sposób wpływa na zmniejszenie dolegliwości bólowych badanych. Poprawa nastąpiła także w zakresie stanu neurologicznego. (PNN 2015;4(3):109–116)

Słowa kluczowe: dyskopatia, ocena, ból, stan neurologiczny

Introduction

Spinal disc disease is defined as a set of structural changes resulting from the disturbance of mutual arrangement of elements constituting the intervertebral disc and spinal canal [1,2]. The clinical presentation of the disease is greatly influenced by the motion segment dysfunction and disc-root conflict which causes irritation or loss of function of a nerve root [3]. The most commonly reported problems among patients struggling with this disease are spinal pains that hinder their daily functioning. Depending on the size of hernia and its direction, pain is felt locally - smaller and central hernias or may radiate to the lower limb in the case of rear-side displacement with compression of nerve roots [4].

The clinical picture and the incidence of neurological complications depend on the location of herniated nucleus pulposus. However, almost 80% of spine discopathies concern lumbosacral spine (L-S discopathy), and 20% of them - cervical segment (C discopathy) [1,2,5].

In every of the communities entering the path of progress of civilization, disc disease is a significant problem, not only medical, but also the economic one, being one of the most important issues of social and pro-health policy of the country. It is estimated that between 15% and 20% of adults within one year experience an episode of pain in the lumbar region of spine, and as much as 50% to 80% of the European population once in a lifetime [6-8].

Treatment of patients with spine discopathy is the subject of interest in numerous medical disciplines and includes non-invasive methods (pharmacotherapy, kinesiotherapy, prophylaxis) as well as invasive ones (surgical treatment) [9,10]. Both therapeutic ways aim to resolve the disc-root conflict. However, none of them results in persistent improvement in all treated patients. A lot of authors emphasize that radicular pain syndromes have a tendency to recur both after non-invasive treatment as well as after the surgery [11-13]. Another worry is also the increase in the frequency of surgical procedures in disc-related pains of the lumbar region [14,15].

The aim of the study was to determine how surgical treatment affects reported ailments and neurological status of patients with spine discopathy.

Material and Methods

Subjects

To realize the goals of the work, a plan of prospective studies was implemented with a double assessment in

time: 1st evaluation - the day before the planned surgical operation, 2nd evaluation - the day of discharge of the patient from the ward.

The study included consecutively admitted patients diagnosed with lumbosacral or cervical discopathy. The diagnosis was based on clinical examination confirmed by a neuroimaging examination of a particular part of spine. Another criterion including patients into the research was performing in every of them one discectomy operation. The study excluded patients diagnosed with spine diseases other than intervertebral lumbosacral or cervical discopathy, who had undergone more than one discectomy surgery. Patients who were discharged from the ward earlier or later than on the seventh day after the surgery and those who were subjected to non-invasive treatment were also excluded. Based on these criteria, 188 patients were included in the research and subjected to the first and second evaluation.

Table 1. Sociodemographic and clinical data

	Analyzed feature	N	%
Sex	Woman	98	52.1
	Man	90	47.9
Age	under 30 years	18	9.6
	30–39 years	46	24.5
	40–49 years	58	30.9
	50–59 years	52	27.7
	Over 60 years	14	7.5
Education	Basic	17	9.0
	Vocational	75	39.9
	Secondary	62	33.0
	Higher	34	18.1
Diagnosis	Lumbosacral discopathy	140	74.5
	Cervical discopathy	48	25.5
Intra-operative diagnosis	<i>Prolapsus</i>	65	34.6
	<i>Protrusio</i>	105	55.9
	<i>Ekstrusio</i>	18	9.6
	C5 - C6	28	14.9
Level of operation	C6 - C7	8	4.3
	L1 - L2	1	0.5
	L2 - L3	4	2.1
	L3 - L4	4	2.1
	L4 - L5	62	33.0
	L5 - S1	69	36.6
BMI	Underweight < 18,5	1	0.5
	Normal weight 18,5 – 24,9	83	44.1
	Overweight 25 – 29,9	73	38.8
	Obesity > 30	31	16.5

Among the subjects there were 98 women and 90 men. The youngest patient was 22 years old and the oldest 72.

The most numerous was the age group 40 - 49 years: 58 patients (30.9%), the group of patients aged 50 - 59 years turned out to be less numerous: 52 people (27.7%). Women were older than men about half a year on average, their average age was 44.6 years. In the research participated more inhabitants of cities - 133 people (70.7%) and those with vocational education - 75 people (39.9%). The subjects with the diagnosis of lumbar discopathy constituted a larger group - 140 people (74.5%). They accounted for almost three quarters of the examined group. In this group, the majority - 69 respondents (49.28%) were operated on the level L5 - S1 and L4 - L5 (62 patients, 44,28%). In the case of cervical discopathy, in more than the half of patients (58.3%) the surgery concerned level C5 - C6. The detailed characteristics of patients are presented in Table 1.

Procedure

The study included clinical and intraoperative diagnosis, the level of the operation, BMI, and neurological status: Laseque's sign, muscle strength, pain, dysesthesia and sphincter disorders. Individual data concerning neurological status were determined on the basis of the analysis of medical records in the following way:

1. Clinical and intraoperative diagnosis and the level of operation - this information was obtained directly from patients' medical records.

2. BMI (*Body Mass Index*)- it was calculated on patient's admission to the ward.

3. Laseque's sign (*Straight Leg Raise Test* - SLR) [16] - was assessed in patients with discopathy of the lower part of spine. The basic version of the Straight Leg Raise Test was taken into account, observing the angle at which the pain occurred . This version proved to be the most suitable to interpret in the presented studies. The evaluation was done by one neurosurgeon in all patients (first and second evaluation). The positive sign was defined as severe and moderate and as a negative one when the value was > 70° [17,18].

4. Muscle strength - *the Medical Research Council scale*, also called Lovett scale, was used to describe this parameter [1,19]. In this examination muscle strength of upper and lower limbs measured was measured, according to the established criteria:

- lack of active muscle contraction - 0°,
- trace of active muscle contraction - 1°,
- pronounced muscle contraction and the ability to perform movement with help and without gravity of the mobile part - 2°,
- the ability to perform an active movement against gravity of the given section - 3°,
- the ability to make an active movement with some resistance - 4°,
- The correct strength, i.e. the ability to perform active movement with full resistance - 5°.

In the subjects with L-S discopathy, muscle strength of lower limbs was evaluated (L - left, R - right), in

patients with cervical discopathy - upper limbs (L - left, R - right). This assessment was made by one neurosurgeon.

5. Pain was evaluated using *The Visual Analog Scale - VAS* [20]. Patients were divided into the relevant groups:

- Group I - 0 points - no pain,
- Group II - 1 - 3 points - weak pain,
- Group III - 4 - 7 points - average pain,
- Group IV - 8 - 10 points - very severe pain.

Ethical considerations

The protocol for this study was accepted by the Local Bioethical Committee, and all participants gave their informed consent to participate in the study.

Statistical Analysis

Calculations were performed using the computer program Microsoft Excel and the program Statistica 6.0. The level $p < 0.05$ was accepted as statistically significant in the work. In the statistical analysis of the material, χ^2 for independence was used (in order to verify the hypotheses concerning the existence of relationships between the analyzed nominal variables) and Spearman nonparametric test for the variables that do not have a normal distribution.

Results

Pain

The prevalence of pain was analyzed in relation to the clinical diagnosis (Table 2). In the case of L - S discopathy, in the first evaluation, the majority of subjects were qualified to group III (34%, 64 people) and group IV (33.5%, 63 people). However, after the surgery, most patients (71 people, 37.8%) were classified as group II. The obtained results are statistically significant: $\chi^2 = 73.137$; $d_f = 6$; $p = 0.000353$; $p < 0.05$.

Table 2. Pain on the VAS scale and clinical diagnosis in the first and second evaluation

Vas Scale groups	First evaluation				Second evaluation			
	L-S Discopathy		C Discopathy		L-S Discopathy		C Discopathy	
	N	%	N	%	N	%	N	%
I	0	0.0	0	0.0	12	6.4	6	3.2
II	13	6.9	8	4.3	71	37.8	23	12.2
III	64	34.0	24	12.8	48	25.5	17	9.0
IV	63	33.5	16	8.5	9	4.8	2	1.1
All	140	74.5	48	25.5	140	74.5	48	26

L - S: $\chi^2 = 73.137$; $d_f = 6$; $j = 0.4353$; $p < 0.05$
 C: $\chi^2 = 25.467$; $d_f = 2$; $j = 0.4427$; $p < 0.05$

When it comes to cervical discopathy, in the first evaluation most people belonged to group III (24 patients, 12.5%) and IV (16 people, 8.5%). After the surgery, similarly to L - S discopathy, the majority of them were in group II: second evaluation - 23 patients, 12.2%. The differences turned out to be statistically significant; $\chi^2 = 25,467$; $d_f = 2$; $j = 0,4427$; $p < 0,05$. That means that after the surgery, both in the case of L - S discopathy, as well as C discopathy, there follows a reduction in pain.

Muscle strength

Assessing patients with L-S discopathy before the surgery, it was observed that in most patients muscle strength was 5° (50.7% left limb, right limb 54.3%). After the operation the number of patients in this group was higher - 75.7% left limb, right limb 82.9% (Table 3).

Table 3. Muscle strength in Lovett scale in L-S discopathy in the first and second evaluation

LOVETT SCALE	L-S discopathy							
	First evaluation				Second evaluation			
	L		R		L		R	
	N	%	N	%	N	%	N	%
0°	0	0.0	0	0.0	0	0.0	0	0.0
1°	0	0.0	0	0.0	0	0.0	0	0.0
2°	2	1.4	0	0.0	0	0.0	0	0.0
3°	13	9.3	4	2.9	4	2.9	1	0.7
4°	54	38.6	60	42.9	30	21.4	23	16.4
5°	71	50.7	76	54.3	106	75.7	116	82.9
All	140	100.0	140	100.0	140	100.0	140	100.0

L (left limb): $r = 0.663790$; $p < 0.05$
 R (right limb): $r = 0.532303$; $p < 0.05$

Improvement also occurred in patients with C discopathy, although here most patients before the surgery were rated at 4° in the Lovett scale for the left limb (62.5% of the patients) and at 5° in the case of the right limb (52.1% of the people). After the performed operation, the majority of subjects received 5° in the above mentioned scale, in both extremities (66.7% left limb, 66.7% right limb) (Table 4).

Table 4. Muscle strength in Lovett scale in C discopathy in the first and second evaluation

LOVETT SCALE	C discopathy							
	First evaluation				Second evaluation			
	L		R		L		R	
	N	%	N	%	N	%	N	%
0°	0	0.0	0	0.0	0	0.0	0	0.0
1°	0	0.0	0	0.0	0	0.0	0	0.0
2°	0	0.0	0	0.0	0	0.0	1	2.1
3°	1	2.1	7	14.6	0	0.0	3	6.3
4°	30	62.5	16	33.3	12	25.0	15	25.0
5°	17	35.4	25	52.1	36	75	32	66.7
All	48	100.0	48	100.0	48	100.0	48	100.0

L (left limb): $r = 0.459005$; $p < 0.05$
 R (right limb): $r = 0.793277$; $p < 0.05$

It should be noted that both in L - S and C discopathy, there were no subjects who received 0° or 1° on the Lovett scale in the first and second assessment. The results proved statistically significant; in all analyzed cases the obtained correlations were at a moderate level ($p < 0.05$).

The results show that there was an increase in the score received on the Lovett scale. In the case of L - S discopathy, improvement was observed in 30.3% of the subjects, lack of improvement in 69.3% of the patients and deterioration in 0.3%. In the subjects with C discopathy, improvement was observed in 32.3%, no improvement - in 66.6% and deterioration - in 1% of the patients.

Laseque's sign

Laseque's sign was assessed among the subjects with discopathy of the lower region of the spine. Prior to the surgery, this symptom was rated as moderate in 62.4% of people and as severe in 5.7%. This means that 68.1% of the patients had positive Laseque's sign before the surgery. After the operation, the percentage was lower - 56% of the patients had positive Laseque's sign. The biggest improvement was observed among patients who at the beginning had severe Laseque's sign (from 5.7% to 3.5% of the patients). Moderate symptom in the second assessment was observed in 52.5%, good - in 43.9% of the patients. Taking into account the results from all the limbs and measurements, statistically significant differences were obtained; correlation at moderate level ($p < 0.05$) (Table 5).

Table 5. Laseque's sign in the first and second evaluation

LASEQUE'S SIGN	First evaluation				Second evaluation			
	L		R		L		R	
	N	%	N	%	N	%	N	%
Good	37	26.4	51	36.4	55	39.3	68	48.6
Moderate	90	64.3	86	61.4	75	53.6	72	51.4
Severe	13	9.3	3	2.1	10	7.1	0	0.0
All	140	100.0	140	100.0	140	100.0	140	100.0

L (left limb): $r = 0.675301$; $p < 0.05$
 R (right limb): $r = 0.733384$; $p < 0.05$

Comparing the obtained results, it can be noticed that there was increase in scores in the analysis of Laseque's sign. The improvement occurred in 46.4% of the patients, no improvement - in 51% of patients, and deterioration in 2.5% of patients. The increase mainly concerned the left limb, by as much as 52.1%.

Dysesthesia

In the case of L - S discopathy, these disorders were present in 61.4% of the patients, while after the surgery they concerned only 29.3% of the subjects. Improvement

in this area was observed in both limbs. This difference is statistically significant ($p < 0.05$) (Table 6).

Table 6. Dysesthesia in the first and second evaluation

DYSESTHESIA	First evaluation				Second evaluation			
	L		R		L		R	
	N	%	N	%	N	%	N	%
L-S discopathy								
Yes	90	64.3	82	58.6	48	34.3	34	24.3
No	50	35.7	58	41.4	92	65.7	106	75.7
All	140	100.0	140	100.0	140	100.0	140	0.00
L (left limb): $r=0.349881$; $p < 0.05$ R(right limb): $r=0.472077$; $p < 0.05$								
C discopathy								
Yes	39	81.3	31	64.6	15	31.3	14	29.2
No	9	18.8	17	35.4	33	68.8	34	70.8
All	48	100.0	48	100.0	48	100.0	48	0.00
L (left limb): $r=0.553832$; $p < 0.05$ P (right limb): $r=0.507519$; $p < 0.05$								

Among the patients with C discopathy, the situation was similar. Improvement in the status of patients was observed while analyzing this disorder: before the surgery it occurred in 72.9% of the patients whereas after the surgery only in 30.3%. The improvement took place in both limbs, the difference is statistically significant ($p < 0.05$) (Table 6).

Sphincter disorders

Sphincter dysfunction occurred in 16.4% of the patients before the surgery and in 2.1% of patients after the surgery performed due to L - S discopathy. In patients with C discopathy prior to the operation the problem occurred in 8.3% of patients, and after the treatment it was not observed in any of the subjects (Table 7).

Table 7. Sphincter disorders in the first and second evaluation

SPHINCTER DISORDERS	First evaluation				Second evaluation			
	L-S Discopathy		C Discopathy		L-S Discopathy		C Discopathy	
	N	%	N	%	N	%	N	%
Yes	23	16.4	4	8.3	3	2.1	0	0.0
No	117	83.6	44	91.7	137	97.9	48	100.0
All	140	100.0	48	100.0	140	100.0	48	100.0

Discussion

The main symptoms of spine diseases are, depending on location, lower back and neck pains. It is the most commonly reported ailment in all studied populations [21-24]. Subjective evaluation of pain is an important factor influencing the motivation for treatment, and also has an impact on the attitude to the environment, perceiving one's life situation or being active [22].

Presented results of the research confirmed that pain is a significant problem for patients with herniated nucleus pulposus, influencing to a large extent their physical and mental state. The best, quick and reliable method evaluating pain intensity seems to be VAS scale, used in this research and useful for testing before and after surgery. Its sensitivity allows assessing the effectiveness of treatment before and after its implementation [25].

According to available literature, approximately 30% of patients after surgical treatment still reports pain and considers the operation as a failure [26,27]. In the presented material, before the surgery, the majority of people felt severe pain (46.8%) and very severe (42%). However, after the operation most of the people (44.3%) evaluated their pain as weak. Average spine pain reduction in the whole group was expressed by the change in the value of 6.5 points prior to the operation to 3.1 points after the surgery. The data showing reduction in pain are also presented by other authors: from 7.2 points to 2.1 points [28], from 6.0 to 2.7 [29], from 5.7 points to 2.5 points [30]. The results of long term studies show that patients operated because of pain, achieve better results shortly after the surgery rather than in the distant period [31,32].

Although the most important reason for patients with herniated nucleus pulposus to make a decision about the surgery is pain, improvement in neurological deficits - muscle strength, sensation, sphincter control and Laséque's sign is also expected [10,18]. The analysis of neurological status, in addition to pain, is another basic criterion for assessing patients with disc disease.

In the group of patients who have undergone the surgery, the most favorable neurological status is observed in the examination immediately and shortly after the operation [10]. Prior to the surgery, foot muscle weakness (L - S discopathy) or hand (C discopathy), of varying severity, was found respectively in 47.5% and 20.7% of the patients. After the treatment, the improvement occurred in approximately 30% of the patients with each analyzed disease. In other studies, deficits in muscle strength before the operation concerned 48.9% of patients [10], 47% [33], and after the operation this percentage was 33.3% [10], 34% [33].

In the world literature one can find reports about the usefulness of some elements of physical examination in the prognosis concerning the effectiveness of treatment of the diseases that are accompanied by pain in the lumbosacral region of spine [34]. One of them is the assessment of Laseque's sign whose sensitivity is assumed to be 98% and specificity 88% [10,17]. This symptom indicates the spinal root compression, but it must be remembered that, at the same time, it does not prove the existence of disc herniation. Patients diagnosed with nucleus pulposus protrusion having the positive result of Laseque's sign before the surgery, more often experience severe pain after discectomy than patients without positive Laseque's sign [18]. According to Summers [35] the occurrence of symptoms

of the sciatic nerve irritation is related to size and direction of nucleus pulposus protrusion. According to studies by Iglesias-Casarrubios [36], a high correlation was found between the positive Laseque's test and poor functional status of the patients 24 and 36 months after the surgery. The results of the authors' own research show that its positive values occurred in 73.6% (left limb) and 63.5% (right limb) of the patients. After performed surgery, these values concerned, respectively 60.7% and 51.4% of the subjects. In studies conducted by Radziszewski [10], the positive unilateral Laseque's sign occurred in 73.9% before the surgery and in 35.1% after the treatment. Bilateral Laseque's sign, in the same study, occurred in 26.1% of the patients before and in 17% of the patients after the surgery.

Analyzing dysesthesia, in the case of L - S discopathy, the disorders occurred in 61.4% of the patients, while after the surgery they concerned only 29.3% of the subjects. Among the patients with C discopathy the situation was similar: prior to the operation this problems occurred in 72.8% of the patients, whereas after the surgery in 30.2% of them. Persistent dysesthesia after the surgery is also confirmed by other authors; Ryang et al. [28] talk about these disorders in 93.5% of patients before the surgical intervention and in 10% of patients after the surgery. On the other hand, Radziszewski [10] writes about dysesthesia present in 66.7% of patients before and 47.2% of patients after the surgery. Persistent sensory disturbances in some patients in the form of tingling, numbness and paresthesiae are most likely to be connected with structural changes at the level of nerve fibers; these disorders are one of the least frequently disappearing dysfunctions [37].

A very important deficit is impaired sphincter function. These disorders occurred in 16.4% of patients before the surgery and in 2.1% of the patients after L - S discopathy surgery. When it comes to patients with C discopathy, prior to the surgery the symptoms occurred in 8.3% of patients, and after that treatment they were not observed in any of the subjects. Improvement in this area was also noticed by other authors: from 27.1% to 18% [10], from 5% to 0% [28].

Conclusions

1. Performed surgery significantly reduces pain in patients.
2. With muscle strength, the progression of changes concerns 30% of the subjects.
3. Analyzing the occurrence of Laseque's sign, the biggest improvement occurred among patients with initial severe Laseque's sign (from 5.7% to 3.5% of the patients).
4. Persistent dysesthesia after performed surgery were observed in approximately 1/3 of the patients.
5. Sphincter disorders occurred in a small percentage of the patients before the operation, the operation itself significantly solved this problem.

Implications for Nursing Practice

Evaluation of neurological status of patients with spinal discopathy should be an integral part of physical examination conducted by a nurse at different stages of neurosurgical treatment. This will allow determining the impact of neurological dysfunction on patient's functioning, identification of current needs and nursing problems or modification of the plan of care.

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